FEASIBILITY STUDY

ROADS - BRIDGES - WATER SUPPLY

RIMINI AREA

FOR

COUNTY OF LEWIS & CLARK

CITY OF HELENA

JUNE, 1981

PROJECT NUMBER 225-21-01-01(30)

M
625.7
M

MORRISON - MAIERLE, INC.

CONSULTING ENGINEERS
HELENA, MONTANA

WITHDRAWN

TABLE OF CONTENTS

Section	Page Number
Introduction	1
1 - Magnitude of Repairs	2
2 - Water System Considerations	3
3 - Roadway and Bridge Repairs	7
4 - Contact with Governmental Agencies	11
5 - Awarding Construction Contracts	13
6 - Recommendations	15
Exhibits:	
Aerial Photo - Alternate Alignments	
Aerial Photo - Total Project	

WK108/M

LEWIS & CLARK LIBRARY
120 S. Last Chance Mall
HELENA, MONTANA 59601

FEASIBILITY REPORT

In late May the Ten Mile Creek watershed was subjected to the most severe runoff and flooding on record. The City of Helena's Ten Mile Water Supply System suffered significant damage to several intake structures, portions of the raw water supply mains and to several sections of the treated water supply lines. As a result the City has lost the use of the majority of the Ten Mile Water Supply capacity and may face severe restriction on water use this summer. Lewis and Clark County has had to construct temporary detours around bridges and road sections damaged by the flood water.

A feasibility study was started on June 19 to determine the best way to repair or replace the flood damaged water-main, roads and bridges in the Ten Mile Creek Canyon between Highway 12 and Rimini about nine miles west of Helena, Montana. This report is a brief written progress report on the engineering and construction considerations underway in connection with the needed repairs.

The purpose of this study is threefold:

(1) to address the magnitude of the repair work;

(2) to address alternative routing of public facilities;

(3) to develop a repair program which will allow the City of Helena maximum use of the Ten Mile Water Supply System and Lewis and Clark County a permanent road facility to Rimini at the earliest possible date.

1 - MAGNITUDE OF REPAIRS

It is premature to estimate total cost of repairs with reasonable accuracy. As soon as plans are developed in greater detail some approximate cost estimates will be prepared. Very roughly, costs are expected to be of the following magnitude.

Construction of new bridges	184,000
Repair of existing roadways	265,000
Repair of existing Waterworks	129,000
Contingencies and location factor 30%	173,000
Subtotal	$ 751,000
Engineering study, design and inspection	109,000
Total Estimated Project Magnitude	$ 860,000

Detail consideration is presently underway on the planning and initiating construction for these facilities.

2 - WATER SYSTEM CONSIDERATIONS

2.01 GENERAL

Early road and water repair considerations very much involved the city water line. Could the water line stay on its present alignment while the road was relocated across the creek? How often did the City have to maintain the line during the winter months? In our review of the project with Chuck Dickert, City Water Superintendent, we learned that the City frequently has to work on the water line to avoid problems with ice, etc. Their requirement for winter access requires a plowed road along the line, therefore the decision was made to construct or repair the City main alongside the county road. If the road is built on another alignment, then the cost of moving the city water main to the same alignment will have to be included. With this in mind, Morrison-Maierle engineers completed the inspection of the flood damaged facilities along Highway 12 to the City Ten Mile Creek water intake structure above Rimini. In general, damage to the Ten Mile Water Supply System can be divided into three categories:

(1) Damage to intake structures due to silt, sand and rock deposition and channel relocation resulting in a bypass of existing structures.

(2) Damage to the 18" concrete raw water supply line due to flood water undercutting and breaking the line, blockage from foreign material entering the line at broken sections, and damage due to emergency road building operations.

(3) Damage to the 16" and 24" finished water along Highway 12 line due to line washout or exposure.

2.02 WATER INTAKES

There are five intake structures included in the lower Ten Mile System. Of these five structures, only Moose Creek intake escaped flood damage.

a. Walker Creek Intake:

Damage at Walker Creek intake consisted of channel relocation to the north of the existing intake structures and partial silt-up of the original inlet channel. Emergency repairs have been accomplished at Walker Creek to divert some of the creek flow back into the original inlet channel. With emergency repairs the City can obtain approximately 4 million gallons of water per day from this intake as of June 28. The emergency repairs consisted of damming the relocated channel with rock fill. A significant portion of the available flow is still passing through this rock fill dam and is being lost for use by the City. Permanent repairs to this facility have been contracted with Branning Construction Company and are to be accomplished on or before July 10, 1981.

b. Minnehaha Intake

Damage at Minnehaha Creek consisted of channel relocation to the north of the existing intake, wash out of a wing wall of the intake structure, deposition of material upstream of intake, possible damage to the overflow weir, sluice gate, intake screen, and wash out of a 15 inch steel pipe and

supporting bridge over Ten Mile Creek connecting Minnehaha intake to the raw water supply line.

c. Beaver Creek Intake

Intake damage at Beaver Creek consisted of partial channel relocation to the south of the existing intake, deposition of material upstream of the intake and in the intake manhole, possible damage to overflow weir, sluice gate and intake screen, and wash out of equipment building.

d. Ten Mile Creek Intake (South of Rimini)

Damage at Ten Mile Creek intake consisted of channel relocation to the west of the existing intake, significant deposition of material upstream of intake in the creek channel, wash out of security fencing, damage to intake screen and possible silt-up of 750 lineal feet of 18" raw water line between the intake reservoir and the first water line manhole.

2.03 RAW WATER SUPPLY LINE FROM RIMINI

The 18" non-reinforced concrete pipe raw water supply line running from Ten Mile Creek intake to the Ten Mile settling basin was broken in nine different locations. These breaks range in length from 25 lineal feet to over 400 lineal feet. At least two of the breaks were reportedly caused not by flooding but by construction equipment during emergency road work. One break has already been repaired by a City crew.

There is also evidence that silt, sand and rock entered the supply line at several of these breaks. The removal of this material may require

high pressure flushing. Between the Ten Mile Creek intake above Rimini and the settling basin near Highway 12, approximately 1600 linear feet of 18 inch water-line was broken and approximately 6300 linear feet of water-line will need cleaning before service is restored.

2.04 FINISHED WATER LINES TO HELENA

Two of the three finished water lines running between the Ten Mile settling basin and the City of Helena were damaged.

Line 1: The 24 inch steel line was exposed where it crosses Ten Mile Creek downstream of the RV Ranch. The line was undamaged except for several pinhole leaks which have been repaired.

Line 2: One of the two 16 inch lines was exposed in two locations near the mouth of Colorado Gulch. The two exposed sections are each approximately 210 feet long and are separated by 265 feet of unexposed line. The upstream section is in reasonable condition with only one damaged joint. The downstream section is missing one segment of pipe and has several damaged joints. A top section of one segment of pipe has been removed to allow the installation of a plug to prevent silt from entering the pipe.

2.05 EMERGENCY WATER INTAKE

It is apparent that the Ten Mile Water System cannot be repaired in time to allow the City to satisfy normal summer time water demands. There-

fore, it may be desirable to install a temporary intake downstream of the damaged water supply line to provide at least a portion of the normal summer time capacity of the Ten Mile System. The most acceptable and less expensive location for such an intake is located upstream of the Walker Creek inlet. The quality of the raw water in this area is presently being surveyed to determine its suitability as a water source.

3 - ROADWAY AND BRIDGE REPAIRS

3.01 GENERAL

There were 16,700 linear feet of road which sustained damage and will be repaired or rebuilt. In addition two bridges were destroyed by the destruction of the north abutments and a Forest Service bridge carrying Minnehaha road traffic over Ten Mile Creek was seriously damaged. Other bridges were slightly damaged before the approach roads washed out and relieved the pressure on the bridges.

3.02 ROADWAY REPAIRS IN GENERAL

It has been concluded most of the length of roadway can be best restored by repair of the existing road and bridges on the existing alignment.

3.03 STUDY OF POSSIBLE RELOCATION VS REBUILDING

a. General Discussion.

A review of the damaged sites by the engineering team resulted in only one area where the alignment of the road and water line should be studied to determine the best location for the future facilities. This location is approximately five miles south of Highway 12 and is in the

immediate vicinity of Minnehaha Road junction with Ten Mile Creek road. The relocated road if selected would be 2900 to 3700 feet in length.

Three alternate alignments were chosen for study to determine the best alignment for the public facilities. An aerial photograph with the alternate alignments is included in this report.

b. Alternate 1

Alternate 1 is about 2,900 feet long and maintains the same alignment as the road and water line occupied prior to the flood. To repair the public facilities if alternate 1 is chosen will require the replacement of a bridge at the north end of the section, the replacement of a small Forest Service bridge at Minnehaha Creek and the replacement of a water line utility bridge between the intake from Minnehaha and the water main. In addition there is need to restore Ten Mile Creek to its former channel and rebuild 1800 feet of road and 900 feet of water main.

c. Alternate 2

Alternatte 2 is about 3700 feet long and establishes a new alignment for both the city water main and the county road. The new alignment eliminates the need for the bridge at the north end of the section by remaining on the west side of the creek. Alternate 2 begins about 400 feet north of the creek crossing and traverses through two twelve degree curves to reach an old railroad grade, then continues south along that grade to a point 350 feet south of the Minnehaha Creek road where it crosses Ten Mile Creek at a new location and intersects the county road. This new alignment eliminates

the need for the bridge at the north end of the section, eliminates the need to rebuild the Forest Service Bridge at Minnehaha Creek, and eliminates the need for the Minnehaha intake utility bridge because the water main will also be on the west side to intercept Minnehaha water before it reaches Ten Mile Creek. It does require one bridge across Ten Mile Creek at the south end.

d. Waterline reconstruction as related to road work

Alternate 2 has the advantage of being completely away from the creek thus reducing the silt and turbidity of the water for the city water supply during the construction of the road and water line. This alignment is away from the stream bed on high ground where future flood damage to the roads and water line would be minimal. The City would have a new water main that extends 4600 feet with adequate manholes to repair and clean the facility and with immediate access for maintenance, which is not true if Alternate 1 is chosen. Though the road replacement is only 3700 feet long the water main would tie into the existing facility below yet another break in the line and would be 4600 feet in length. Alternate 2 would replace a section of road the County Road Foreman said always was a maintenance problem.

e. Difficulties involved more with Alternate 2 than other considerations

Alternate 2 has some disadvantages, too. There is a group of cabins west of the railroad grade whose value may be reduced because of the close proximity of the road. In addition the railroad grade has 13 power poles which would need to be moved. The costs required to solve these right-of-way problems has been included in the costs of using Alternate 2 as the new

alignment. A temporary problem for which the true cost would be difficult to calculate is the inconvenience caused motorists during the construction period. Much of the alignment of Alternate 2 is being used as a detour around the washed out road and bridges. Traffic would need to be maintained through the construction area if alternate 2 is chosen resulting in delays to both the contractor and motorist. If Alternate 1 is chosen as the permanent road location then Alternate 2 would remain a detour and the public and contractor would not be in conflict.

f. Alternate 3

Alternate 3 was visualized as having the best of both of the other alternates because it would use the higher railroad grade [where the flood water did the most damage to the road] and water line but would swing over to the east side of Ten Mile Creek before it encroached upon the cabin site and would use original road where it is still undamaged. However the cost of the extra bridges over Ten Mile Creek increased the costs to about $100,000 more than the replacement of all facilities on the original alignment. For this reasons Alternate 3 is no longer considered a acceptable alternative.

g. Estimated Cost of Alternatives.

Cost estimates prepared with somewhat limited information indicate the following construction costs for the three alternatives studied for the heavily damaged section of road along Ten Mile Creek in the Minuehaha area. The cost estimates have been prepared assuming normal construction in easily accessible locations. An additive of 35% has been applied to allow

for the location of the project, the fact that it is to be moved in on promptly and it is to be accomplished in a very short period. Historically, forest service type roads in the back country have cost significantly more than comparable type roads close to a city.

	Estimated Cost	Contingency	Total Estimated
Alternate 1 - 2900' rebuild	$ 267,000	$ 93,000	$ 360,000
Alternate 2 - 3700' new	297,000	104,000	401,000
Alternate 3 - new	367,000	128,000	495,000

The above costs include all expected construction, right-of-way, utility moves but do not include engineering costs. Engineering costs would not vary greatly from one alternate to the other, but would be slightly more for new alignments. Thus costs are only for the 2900 or 3700 feet of roadway being considered to rebuild or replace the most seriously damaged section of the Ten Mile roadway. This is only a portion of the approximately eight miles of gravel road being considered between Highway 12 and Rimini.

4 - CONTACT WITH GOVERNMENTAL AGENCIES

a. FEMA: The Engineers have endeavored to seek information and assistance from several governmental agencies. The Federal Emergency Management Agency has an emergency office in Helena and their staff has been very helpful.

b. Representatives of the U.S. Forest Service and the Montana Fish, Wildlife and Parks Department reviewed the damaged sections of the road and

water main and offered helpful suggestions and their cooperation. To make necessary repairs, the Fish, Wildlife and Parks representative suggested that where the creek encroached upon the roadway alignment and had to be moved to a location nearer to its previous channel, that a new channel be dug from the downstream end to the upstream end. After the creek is relocated, work on the road could begin without further muddying the stream.

The Forest Service said they would consider sites we chose for materials for stream bank protection or embankment and if they could not approve the source, then they would look for and permit another near by source. This cooperation gives assurance of being able to complete the road, bridges and water main. It is understood though that there is a charge of $0.75 a ton for any material removed and the borrow site must be left in a proper condition.

The costs of Forest Service materials as well as the possibility of scaring the area where material is removed is ample incentive to try to find acceptable sources at other locations and pay for the extra haul that may be required.

c. Design Criteria

In our investigations, the question of design criteria frequently was discussed. One of the more important criteria for determining the size of bridges and the height of bank protection for roads was the high water elevation at the 25-year flood frequency. The Damage Survey Reports called for additional hydrologic analysis for Ten Mile Creek so our hydraulic engineer worked through FEMA to obtain approval of funding for a computor analysis

of all 105 years of record for this drainage, which has been kept since 1876. The USGS keeps these records and they will permit the computer analysis to include the 1981 flood data so a new 25-year flood range can be established. The USGS thought the computer analysis could be completed before July 4th.

5. AWARDING CONSTRUCTION CONTRACTS

a. Urgency to Start Construction.

Because of the urgency of this project, there is a strong reason to deviate from standard procedure of completing the design, specifications and estimated quantities in the office before letting the project to contract. Morrison-Maierle could short cut the above procedure and let the contract three weeks earlier. At best, construction might be fully underway by the first of August. Using usual and normally preferred means of preparing plans, seeking bids and awarding contracts, construction probably would not be underway until late August. September will probably be satisfactory for construction on most days, and October on many. With winter starting sometime in November, full utilization of the month of August is very much needed.

b. Usual design and contracting.

Generally, the owner of a project is served best by allowing generous time for the preparation of engineering design, complete plans, detail specifications and full review and checking of proposed contract documents. This could permit bidding roads, bridges and water work on either a "Lump Sum"

or "Unit Price" basis or a combination of the two. Unknowns would be reduced to a minimum for the contractor and economy is normally achieved. However, time is needed.

c. EQUIPMENT, MATERIALS AND TIME BID ITEMS.

With winter forming a barrier on 1981 construction work, serious consideration is being given to using other contracting for methods some of the proposed work.

The use of this contracting procedure will require the engineer to estimate hours of equipment time necessary to completely restore each damaged section. Contractors would then bid on a unit price per hour for each type of equipment required to complete the work. In addition, an item for man days of supervision would be included to allow for the contractor's foreman to supervise the contractor's operations during times of significant work activity. An item for moving costs into and out of the project area will also be required.

Plans and brief specifications will still be needed with these items but they can be less detailed and the work prior to construction will be less.

Specifications will have to be carefully written such that the contractor cannot collect on rent for the equipment if it is not being used or used in an inefficient manner to prolong the time. When a client wishes to use the above method, it is extremely important to have an experienced

construction engineer in charge of the project to insure that the work is being accomplished efficiently, and a person may be needed full-time just to keep track of equipment utilization.

This type construction usually does not decrease the engineering costs as more engineering time must be used on the construction phase and the contract costs might rise slightly because there are no firm quantities upon which to base a bid and many factors are less certain. The one big advantage that make this method worth considering is the time to "Start" construction. A contractor could be selected and working by the fourth week of July. Possibly three weeks to a month lead time would be gained which gives the contractor an opportunity to work in better weather when the best progress can be made. It would greatly increase the opportunity to finish the proposed work before winter.

6. RECOMMENDATIONS

1. Three alternates were studied in the Minnehaha Creek area to replace the road, bridges and water line. Alternate 1 was a study of the conditions and costs if the road and water line returned to the original alignment. Alternate 2 for the most part followed an old railroad grade and is higher about the creek. From the estimates of costs that were made with the information available alternate 1 is about 10% less in cost than alternate 2. A good road adequately protected can be rebuilt on the original alignment and the water line repair should not be too difficult once the creek is moved into its original channel.

Alternate 1 will not require additional right-of-way or require the movement of the power line. A detour is already built around the construction area thus less of a motorist problem with construction equipment will result. Morrison-Maierle recommends that alternate 1 be used for the road alignment through the area near Minnehaha Creek.

2. The need to begin construction at the earliest possible date plus the need to repair damaged sections along a 7 mile length of project lends itself to the use of unit price bids on equipment rental, costs of materials and supervision by the day. Other portions of the project lend themselves to a unit price bid per volume or weight of material in place or lump sum bids for a unit of work to be completed as specified. Morrison-Maierle proposes to blend these methods into a contract or contracts such as to begin restoration work at an early data consistent with good engineering and accounting practice and meeting the legal requirements of competitive bids from contractors.

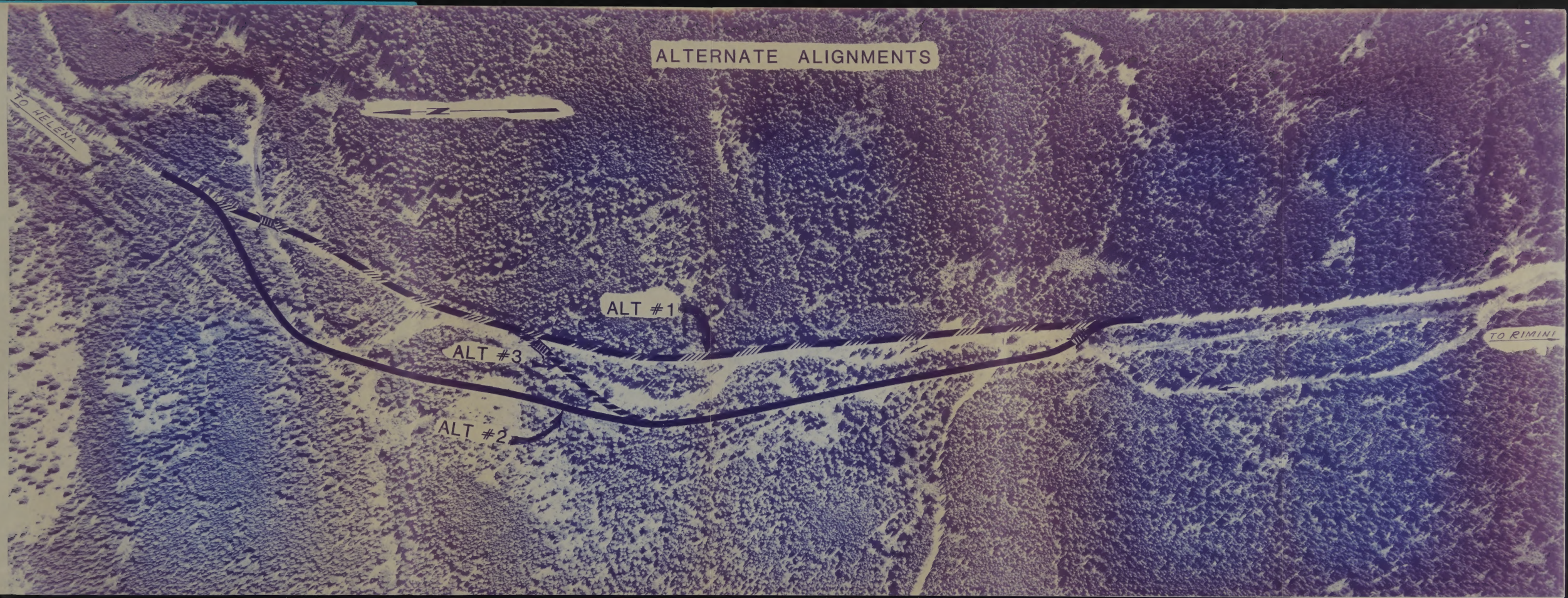
3. It is recommended that the new bridges be replaced with prestressed concrete spans supported on steel piles designed to pass a twenty five year frequency flood based on computations including the recent flood of 1981.

4. It is recommended that the Helena City water line be restored on the same alignment as the County road. Frequent work on the line during winter months requires that a well maintained access road be available to City crews. Therefore, the water line will be restored on its present alignment unless there is a decision by the County-City to approve alternate 2 after they review the report and have the public meeting.

RN

TO HELENA

TO RIMINI


ALTERNATE ALIGNMENTS
TO HELENA
ALT #1
ALT #3
ALT #2
TO RIMINI

LEWIS & CLARK
LIBRARY
Lewis & Clark Library
120 S. Last Chance Gulch
Helena, MT 59601

Montana State Library
3 0864 1007 0430 6